PATENT ABSTRACTS OF JAPAN

(11)Publication number : **10-233925**

(43)Date of publication of application : **02.09.1998**

(51)Int.Cl. H04N 1/409

(21)Application number : **09-046965**

(22)Date of filing : **17.02.1997**

(71)Applicant : **RICOH CO LTD**

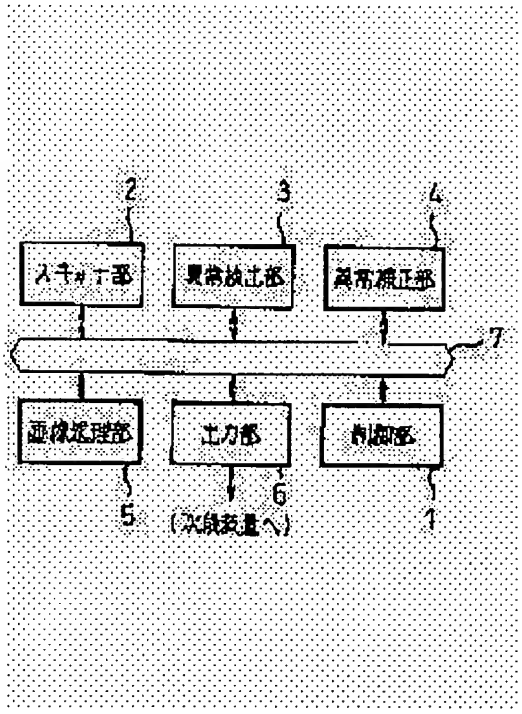
(72)Inventor : **KOIKE KAZUMASA**

(54) IMAGE READER

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a read image satisfactory in image quality by detecting an abnormal pixels by reading a white plate for shading correction and by directly correcting the abnormal pixel on the image data acquired by reading a target original.

SOLUTION: When an abnormality detecting part 3 reads a reference white image, it stores image data that is outputted by a scanner part 2 in a register that stores image data of five continuous pixels that are in horizontal scanning positions and detects an abnormal pixel whose read result is abnormal about image data of a horizontal scanning position of a central position that is stored in the register. When an abnormality correcting part 4 reads a target original image, it corrects image data that is outputted by the part 2 based on a decision result of abnormal pixel/normal pixel about pixels of each horizontal scanning position which is decided by the part 3. An image processing 5 converts image data of M bits into image data of N bits, and an outputting part 6 outputs read image data of N bits to the next stage device.



LEGAL STATUS

[Date of request for examination] 21.02.2002

[Date of sending the examiner's decision of 01.03.2005

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the image reader which can control abnormalities in reading, such as a pixel omission at the time of reading.
[0002]
[Description of the Prior Art] The image reader which carries out photo electric conversion, acquires a picture signal, carries out digital processing of the picture signal, and is conventionally outputted as output image data of predetermined bit width of face while disassembling a manuscript image into a pixel using the Rhine image sensors etc. is used widely.
[0003] In this image reader, when the defect of the dirt of the optical system of the failure produced on the optical path from a manuscript image side to the light-receiving side of a line MEJI sensor, for example, contact glass, a mirror, a lens, etc. or the component of the Rhine image sensors had arisen, the reading image of a specific horizontal-scanning location had produced un-arranging, such as carrying out a white omission.
[0004] As what cancels this un-arranging, although indicated by JP,63-191760,U, the light source is irradiated at a white reference plate, the reflected light is changed into an electrical signal, the electrical signal is differentiated, adhesion of dust is detected, and the picture input device which memorized the electrical signal after dust was removed as white reference level is proposed like, for example.
[0005]
[Problem(s) to be Solved by the Invention] However, conventionally [this], with equipment, since the electrical signal after dust was removed was used as white reference level, although it was effective, there is no effectiveness in the reading image failure by the dirt of the optical system on an optical path which was mentioned above, the defect of the component of the Rhine image sensors, etc. in any way, and it had produced un-arranging [of having had a bad influence on image reading] on the contrary to the dust on a white orientation plate.
[0006] This invention is made in view of this actual condition, and aims at offering the image reader which can improve the image quality of a reading image.
[0007]
[Means for Solving the Problem] An image scan means for this invention to scan a manuscript image optically, to decompose it into a pixel, and to form the analog picture signal corresponding to the concentration value of each pixel, An analog-to-digital-conversion means to change into the 1st image data of the 1st bit width of face the analog picture signal outputted from the above-mentioned image scan means, An abnormality pixel detection means to detect an abnormality pixel based on the 1st image data of each pixel outputted from the above-mentioned analog-to-digital-conversion means, An abnormality pixel amendment means to amend the abnormality pixel which the above-mentioned abnormality pixel detection means detected based on the 1st image data of the perimeter pixel of the abnormality pixel, and to output the 1st amendment image data, About an abnormality pixel, the 1st amendment image data outputted from the above-mentioned abnormality pixel amendment means

except an abnormality pixel It has an image-processing means to change the 1st image data of the above into the 2nd image data of the 2nd bit width of face, respectively, and an output means to output the 2nd image data outputted from the above-mentioned image-processing means. Moreover, said abnormality pixel amendment means amends the 1st image data of said abnormality pixel by processing which calculates the interpolation value based on the 1st image data of said perimeter pixel.

[0008] Moreover, the Rhine image sensors which scan the manuscript image of the shape of Rhine which it converged on the Rhine-like light sensing portion, decompose into a pixel, and form the analog picture signal for one line corresponding to the concentration value of each pixel, An image scan means to move relatively the manuscript image of the shape of Rhine which it converges on the light sensing portion of the above-mentioned Rhine image sensors in the direction of vertical scanning of the manuscript image synchronizing with reading actuation of the above-mentioned Rhine image sensors, It has an analog-to-digital-conversion means to change into the 1st image data of the 1st bit width of face the analog picture signal outputted from the above-mentioned Rhine image sensors. When a leucoplast is read with the above-mentioned Rhine image sensors The attention pixel which saved at the register the 1st image data of each pixel outputted from the above-mentioned analog-to-digital-conversion means about the circumference pixel of the predetermined number consisting mainly of an attention pixel and this attention pixel, and was memorized by that register, It is based on the concentration difference which appears in the 1st image data of two or more circumference pixels. While judging whether the attention pixel is an abnormality pixel, when the target manuscript image is read with the above-mentioned Rhine image sensors About the 1st image data of the above of the horizontal-scanning location judged to be an abnormality pixel While outputting after forming the 1st amendment image data with the application of predetermined amendment processing based on the 1st image data of the predetermined number before and behind the horizontal-scanning location and changing the 1st amendment image data into the 2nd image data of the 2nd bit width of face After changing the 1st image data into the 2nd image data of the 2nd bit width of face, it is made to output about the 1st image data of the above of the horizontal-scanning location which was not judged to be an abnormality pixel. Moreover, said leucoplast is a white plate for shading compensations, and it is good to be made to perform reading of this white plate and the judgment of said abnormality pixel in advance of manuscript reading of the purpose. Moreover, said leucoplast is a white manuscript and it is good to be made to perform reading of this white manuscript and the judgment of said abnormality pixel in advance of manuscript reading of the purpose. Moreover, the number of said circumference pixels saved at said register is good to suppose that it can change suitably. Moreover, the number of said circumference pixels saved at said register is good to set it as the value according to the reading resolution of a manuscript image. Moreover, said amendment processing can ****** processing which computes the interpolation operation value of the 1st image data of the above-mentioned horizontal-scanning location based on said 1st image data of the predetermined number before and behind the horizontal-scanning location judged to be said abnormality pixel.

[0009] Moreover, the Rhine image sensors which scan the manuscript image of the shape of Rhine which it converged on the Rhine-like light sensing portion, decompose into a pixel, and form the analog picture signal for one line corresponding to the concentration value of each pixel, An image scan means to move relatively the manuscript image of the shape of Rhine which it converges on the light sensing portion of the above-mentioned Rhine image sensors in the direction of vertical scanning of the manuscript image synchronizing with reading actuation of the above-mentioned Rhine image sensors, It has an analog-to-digital-conversion means to change into the 1st image data of the 1st bit width of face the analog picture signal outputted from the above-mentioned Rhine image sensors. When a leucoplast is read with the above-mentioned Rhine image sensors The attention pixel which saved at the register the 1st image data of each pixel outputted from the above-mentioned analog-to-digital-conversion means about the circumference pixel of the predetermined number consisting mainly of an attention pixel and this attention pixel, and was memorized by that register, It is based on the concentration difference which appears in the 1st image data of two or more circumference pixels. While judging whether the attention pixel is an abnormality pixel, when the target manuscript image is read with the above-

mentioned Rhine image sensors After changing the 1st image data of the above into the 2nd image data of the 2nd bit width of face, about the 2nd image data of the above of the horizontal-scanning location judged to be an abnormality pixel While forming amendment image data with the application of predetermined amendment processing based on the 2nd image data of the predetermined number before and behind the horizontal-scanning location and outputting as output image data It is made to output the 2nd image data as output image data about the 2nd image data of the above of the horizontal-scanning location which was not judged to be an abnormality pixel. Moreover, said 2nd bit width of face is 1-bit width of face, and when a nearby non-abnormality pixel is a black pixel, it is good [said amendment processing] for the horizontal-scanning location judged to be said abnormality pixel to amend the pixel value of the horizontal-scanning location judged to be the abnormality pixel to a black pixel.
[0010] Moreover, an image scan means to scan a manuscript image optically, to decompose into a pixel, and to form the analog picture signal corresponding to the concentration value of each pixel, An analog-to-digital-conversion means to change into the 1st image data of the 1st bit width of face the analog picture signal outputted from the above-mentioned image scan means, An abnormality pixel detection means to detect an abnormality pixel based on the 1st image data of each pixel outputted from the above-mentioned analog-to-digital-conversion means, An image-processing means to change into the 2nd image data of the 2nd bit width of face the 1st image data outputted from the above-mentioned analog-to-digital converter, An abnormality pixel amendment means to amend the abnormality pixel which the above-mentioned abnormality pixel detection means detected based on the 2nd image data of the perimeter pixel of the abnormality pixel, and to output amendment image data, It has an output means to output the 2nd image data of the above for the amendment image data outputted from the above-mentioned abnormality pixel amendment means about an abnormality pixel as output image data, respectively except an abnormality pixel.
[0011]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail, referring to an accompanying drawing.
[0012] Drawing 1 shows the image reader concerning one example of this invention.
[0013] In this drawing, a control section 1 is for performing motion control of each part of this image reader, and image reading control, and the scanner section 2 outputs the M bits (for example, 8 bits) image data of a predetermined number while disassembling a manuscript image into a pixel in predetermined resolution (for example, 400dpi) using the Rhine image sensors. Moreover, analog processing of the shading compensation of an image etc. is made by this scanner section 2.
[0014] A reading result detects an unusual abnormality pixel about the image data of horizontal-scanning location [of the mid gear which saved the malfunction detection section 3 at the register which can save the image data of the pixel of five continuous horizontal-scanning locations when the white image of criteria was read, as showed the image data outputted from the scanner section 2 to drawing 2 , and was saved at the register] R (n). Moreover, if it is the pixel of the same horizontal-scanning location even if it is the image of different Rhine, since image reading is carried out in the scanner section 2 in this case using the Rhine image sensors, the judgment result of an abnormality pixel or a normal pixel will be the same, therefore the judgment result of an abnormality pixel or a normal pixel will be obtained about the pixel of each horizontal-scanning location.
[0015] Moreover, in case the abnormality amendment section 4 reads the target manuscript image, it amends the image data outputted from the scanner section 2 based on the judgment result of the abnormality pixel / normal pixel about the pixel of each horizontal-scanning location which the malfunction detection section 3 judged.
[0016] The image-processing section 5 changes M bits (8 bits) image data into image data (N bit, for example, 1 bit, or 4 bits). When N bit is 1 bit, it becomes the so-called binarization processing.
[0017] Moreover, the output section 6 outputs the reading image data of N bit to next step equipment. Moreover, these control sections 1, the scanner section 2, the malfunction detection section 3, the abnormality amendment section 4, the image-processing section 5, and the output section 6 are connected to the bus 7, and an exchange of the data between each of these elements is made through this

bus 7.
[0018] Drawing 3 shows an example of the processing at the time of image reading of this image reader.

[0019] First, in advance of reading of the purpose manuscript, the white plate for shading compensations (illustration abbreviation) is read, it is then read and obtained, and abnormality pixel detection processing (processing 101) is performed by the malfunction detection section 3 based on the image data outputted from the scanner section 2.
[0020] At this time, for example, image data, it is 8 bit data, and judges whether the attention pixel of horizontal-scanning location R (n) is an abnormality pixel about the image data which data "255" saved at the register which showed the malfunction detection section 3 to drawing 2 based on the following formula (I) supposing data "0" were the white maximum level on the black maximum level.
[0021]
if (W(n)-W(n-2) >Th) (and (W(n)-W(n+2) >Th)) The abnormality pixel in R(n) = else R(n) = normal pixel .... (I)
[0022] Here, Th is a predetermined threshold for an abnormality pixel judging, and is experimentally calculated about the resolution of an image etc. Moreover, when W (n), and W (n-2) and W (n+2) read the white pixel of criteria, the image data of horizontal-scanning location R (n), and R (n-2) and R (n+2) is expressed, respectively.
[0023] moreover -- "-- the time of the logical value of "" (conditions) of the formula (false type) if (conditions) processing 1 else processing 2" being "truth" -- "-- processing 1" is performed, and "processing 2" is performed when the logical value of "" (conditions) is a "false". " -- ** -- it says.
[0024] Next, the target manuscript is read (processing 102) and an amendment operation is performed by the abnormality amendment section 4 about the image data outputted from the scanner section 2 at this time (processing 103).
[0025] For example, in the abnormality amendment section 4, amendment image data is computed based on the following formula (II) about the image data of horizontal-scanning location [of the mid gear which saved the image data of the pixel of five continuous horizontal-scanning locations with having been shown in drawing 2 at the same register, and was saved at the register] R (n).
[0026]
if (R(n-1) = normal pixel) (and (abnormality pixel in R(n) =) -- and (R(n+1) = normal pixel)) G' (n) = (G (n-1) +G (n+1))/2 else (and (abnormality pixel in R(n-1) =) -- and (abnormality pixel in R(n) =) -- and (R(n+1) = normal pixel)) if (R(n-2) = normal pixel) G' (n) = (G(n-2) +2*G (n+1))/3 else if (R(n-1) = normal pixel) (and (abnormality pixel in R(n) =) -- and (abnormality pixel in R(n+1) =) -- and (R(n+2) = normal pixel)) G' (n) = (2*G(n-1) +G (n+2))/3 else G' (n) =G (n) .... (II)
[0027] Here G (n-2), G (n-1), G (n), and G (n+1) and G (n+2) it can set to the register shown in drawing 2 -- it is each the value of the image data in the horizontal-scanning locations R (n-2), R (n-1), and R (n), and R (n+1) and R (n+2), and G' (n) expresses the value of the output image data after amendment.
[0028] Moreover, in a formula (II), the event "the pixel of the horizontal-scanning location R of a register (n-1) is judged as a normal pixel" is expressed in "" (R(n-1) = normal pixel).
[0029] And output image data G' (n) computed by doing in this way is changed into the image data of N bit by the image-processing section 5 (processing 104), and the image data of N bit after the conversion is outputted to next step equipment through the output section 6 (processing 105).
[0030] In this example, thus, abnormality pixel detection It carries out by reading the white plate for shading compensations. Abnormality pixel amendment Since the purpose manuscript is directly performed to the image data read and obtained, even if dirt is in the optical system of the contact glass arranged on the optical path from a manuscript image side to the light-receiving side of a line MEJI sensor, a mirror, a lens, etc. Or even if it is the case where the defect of the component of the Rhine image sensors has arisen, image data can be amended appropriately and the good reading image of image quality can be obtained.
[0031] By the way, in the example mentioned above, when the scanner section 2 is equipped with the white plate for shading compensations, and the image of the white plate is read, it is made to perform

abnormality pixel detection, but when it does not have this white plate, it is good to read the dummy manuscript of all whites and to be made to perform abnormality pixel detection in advance of reading of the purpose manuscript, in the case of the reading.
[0032] An example of processing in this case is shown in drawing 4 .
[0033] In this case, it investigates whether malfunction detection mode is first set up to the control section 1 by the proper means (for example, a high order control means or the actuation means of this image reader etc.) which are not illustrated (decision 201). By the case where malfunction detection mode is set up, since the dummy manuscript (illustration abbreviation) of all whites is set when the result of decision 201 is set to YES, the image of the dummy manuscript is read, it is then read and obtained, and the same abnormality pixel detection processing (processing 202) as **** is performed by the malfunction detection section 3 based on the image data outputted from the scanner section 2.
[0034] Moreover, by the case where malfunction detection mode is not set up, when the result of decision 201 is set to NO next, the target manuscript is read (processing 203) and the same amendment operation as **** is performed by the abnormality amendment section 4 about the image data outputted from the scanner section 2 at this time (processing 204).
[0035] And the image data after amendment is changed into the image data of N bit by the image-processing section 5 (processing 205), and the image data of N bit after the conversion is outputted to next step equipment through the output section 6 (processing 206).
[0036] Thus, in this case, even when it does not have the white plate for shading compensations, image data can be amended appropriately and the good reading image of image quality can be obtained.
[0037] By the way, after applying amendment processing of an abnormality pixel about M-bit image data, he is trying to change and output to the image data of N bit in the example mentioned above, but after changing M-bit image data into the image data of N bit, amendment processing of an abnormality pixel is also applicable about the image data of this N bit.
[0038] An example of processing in that case is shown in drawing 5 .
[0039] First, in advance of reading of the purpose manuscript, the white plate for shading compensations (illustration abbreviation) is read, it is then read and obtained, and abnormality pixel detection processing (processing 301) is performed by the malfunction detection section 3 based on the image data outputted from the scanner section 2.
[0040] Next, the target manuscript is read (processing 302) and it changes into the image data of N bit by the image-processing section 5 about the M-bit image data outputted from the scanner section 2 at this time (processing 303). Here, in being N= 1, processing of this image-processing section 5 turns into binarization processing.
[0041] Subsequently, an amendment operation is performed by the abnormality amendment section 4 about the image data after this binarization processing (processing 304). In this case, in the abnormality amendment section 4, amendment image data is computed based on the following formula (III) about the image data of horizontal-scanning location [of the mid gear which saved the image data of the pixel of five continuous horizontal-scanning locations with having been shown in drawing 2 at the same register, and was saved at that register] R (n).
[0042]
if (R(n-1) = normal pixel) (and (abnormality pixel in R(n) =) -- and (R(n+1) = normal pixel)) G'(n) =(G (n-1)) OR (G (n+1)) else if (R(n-2) = normal pixel) (and (abnormality pixel in R(n-1) =) -- and (abnormality pixel in R(n) =) -- and (R(n+1) = normal pixel)) G' (n) =G (n+1) else if (R(n-1) = normal pixel) (and (abnormality pixel in R(n) =) -- and (abnormality pixel in R(n+1) =) -- and (R(n+2) = normal pixel)) G'(n) =G(n-1) else G' (n) =G (n) .... (III)
[0043] Here G (n-2), G (n-1), G (n), and G (n+1) and G (n+2) it can set to the register shown in drawing 2 -- it is each the value of the image data in the horizontal-scanning locations R (n-2), R (n-1), and R (n), and R (n+1) and R (n+2), and in the case of a black pixel, data "1" are taken, and, in the case of a white pixel, data "0" are taken. Moreover, G' (n) expresses the value of the output image data after amendment. Therefore, since it is changed in this case so that it may permute by the black pixel if possible when an attention pixel is an abnormality pixel, the white omission of an image etc. can be

prevented.
[0044] And the image data of N bit after the conversion is outputted for the image data after amendment to next step equipment through the output section 6 (processing 206).
[0045] Thus, in this example, since abnormality amendment is performed according to the number of bits of the image data finally outputted, a circuit scale required for the abnormality amendment processing can be made small, and equipment cost can be reduced more.
[0046] If an abnormality pixel is permuted by the interpolation operation value from a circumference pixel in N bit transform processing of the image-processing section 5 in a place based on the image data after N bit conversion when false halftone processing of dithering, error diffusion process, etc. applies, it will become the image which lost the regularity of the geometrical pattern of false halftone processing.
[0047] therefore, in this case, it is desirable to perform an abnormality amendment operation about the image data of M bit before N bit conversion of the image-processing section 5 preferably [performing an abnormality amendment operation about the image data after N bit conversion of the image-processing section 5].
[0048] moreover, in the image-processing section 5, when variable power processing is performed The horizontal-scanning location of subject-copy image data and a horizontal-scanning location with the image data after variable power processing are not in agreement, and the horizontal-scanning location of subject-copy image data is computed from the horizontal-scanning location of the image data after variable power processing. It is desirable that the pixel of subject-copy image data performs an abnormality amendment operation about the image data before variable power processing also in this case since an abnormality pixel needs to judge whether it is a normal pixel.
[0049] When the reading resolution of the scanner section 2 is 200dpi and a formula (I) is applied, the effect of fine dust stops by the way, reflecting in the judgment result of abnormality pixel detection, although the example mentioned above explained malfunction detection processing about the case where the reading resolution of the scanner section 2 is 400dpi.
[0050] Then, it is good to apply the following formula (IV) and to be made to judge an abnormality pixel in this case.
[0051]
if (W(n)-W(n-1) >Th) (and (W(n)-W(n+1) >Th)) The abnormality pixel in R(n) = else R(n) = normal pixel .... (IV)
[0052] In this case, since an abnormality judging is performed based on the pixel of the horizontal-scanning locations R (n-1) and R (n+1) which adjoin horizontal-scanning location R (n), it is easy to be influenced of fine dust etc., and an abnormality judging can be performed appropriately.
[0053] Therefore, when the reading resolution of the scanner section 2 is 200dpi, while it equips the malfunction detection section 3 with the malfunction detection processing by the formula (I), and the malfunction detection processing by the formula (IV), and performing malfunction detection processing of a formula (IV) If it is made to perform malfunction detection processing of a formula (I) when the reading resolution of the scanner section 2 is 400dpi, the common malfunction detection section 3 is applicable by the case where they are the case where the reading resolution of the scanner section 2 is 200dpi, and 400dpi.
[0054] Moreover, it is easy similarly to constitute the malfunction detection section 3 further applicable to much reading resolution.
[0055]
[Effect of the Invention] As explained above, according to this invention, abnormality pixel detection It carries out by reading the white plate for shading compensations. Abnormality pixel amendment Since the purpose manuscript is directly performed to the image data read and obtained, even if dirt is in the optical system of the contact glass arranged on the optical path from a manuscript image side to the light-receiving side of a line MEJI sensor, a mirror, a lens, etc. Or even if it is the case where the defect of the component of the Rhine image sensors has arisen, image data can be amended appropriately and the effectiveness that the good reading image of image quality can be obtained is acquired.
[0056] Moreover, even when it does not have the white plate for shading compensations, image data can

be amended appropriately and the effectiveness that the good reading image of image quality can be obtained is also acquired.

[0057] Moreover, since abnormality amendment is performed according to the number of bits of the image data finally outputted, a circuit scale required for the abnormality amendment processing can be made small, and the effectiveness that equipment cost can be reduced more is also acquired.

[Translation done.]